**Citation:**

Yen CE, Yen CH, Huang MC, Cheng CH, Huang YC. Dietary intake and nutritional status of vegetarian and omnivorous preschool children and their parents in Taiwan. *Nutr Res.* 2008 Jul;28(7):430-6.

**PubMed ID:** 19083442

**Study Design:**

Cross-sectional Study

**Class:**

D - Click here for explanation of classification scheme.

**Research Design and Implementation Rating:**

POSITIVE: See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

The aim of this study was to assess and compare dietary intake and nutritional status of vegetarian and omnivorous preschool children and their parents.

**Inclusion Criteria:**

- Vegetarian and omnivore preschool children with age ranging from 2 to 6 years and one of their parents
- Vegetarians defined as someone who ate neither meat nor fish and had followed this diet practice for at least 6 months and were planning to continue.
- Omnivores were defined as someone who ate food of both plan and animal products
- Informed consent was obtained for each participant.
- The study was approved by the institutional review board of Chung Shan Medical University, Taichung, Taiwan.

**Exclusion Criteria:**

None were specified.

**Description of Study Protocol:**

**Recruitment**

Vegetarian and omnivore preschool children with age ranging from 2 to 6 years and one of their parents were recruited from legally registered kindergartens in Taichung city, located in the

central part of Taiwan.

**Design:** Cross-sectional study

**Blinding used (if applicable):** not applicable

**Intervention (if applicable):** not applicable

**Statistical Analysis**

- Differences in subjects' demographic characteristics, anthropometry, nutrient intake, and biochemical measurements between vegetarians and omnivores were determined using the Student t test.
- When data were skewed rather than normally distributed, differences were determined using the Mann-Whitney rank test.
- Pearson correlation coefficients were performed to assess the relationship between dietary variables and nutritional status parameters.
- Data was analyzed using the SPSS software package (version 12.0).
- Statistical results were considered statistically significant at $P<.05$.

**Data Collection Summary:**

**Timing of Measurements**

- Nutrient Intake: 3-day diet record for 3 consecutive days (2 weekdays and 1 weekend day).
- All measurements taken 1 time at the beginning of study.

**Dependent Variables**

- Body weight and height were measured·
- Body mass index: for parents, a BMI lower than 18.5 kg/$m^2$ indicated that the subject was lean; 24 to 27 kg/$m^2$, overweight; and higher than 27 kg/$m^2$, obese.
- Weight-for-height index (WHI). WHI = [actual weight (kg)/actual height (cm)]/[$50^{th}$ percentile expected weight (kg) for age/$50^{th}$ percentile expected height (cm) for age]. A WHI lower than 0.8 indicated that the preschool subject was lean; 0.8 to 0.89, underweight; 0.9 to 1.09, normal; higher than 1.1 overweight; and higher than 1.2 obese.
- Triceps skinfold thickness (TSF) was measured at the midpoint of the nondominant upper posterior arm using a Lange skinfold caliper.
- Mid-arm circumference (MAC) was measured at the midpoint of the upper arm.
- Mid-arm muscle circumference (MAMC) and arm muscle area was then calculated. MAMC (cm) =MAC (cm) – [TSF (cm) x 3.14].
- Arm muscle area ($mm^2$) = [MAC(mm)-TSF(mm) x 3.14)]$^2$/4
- Body fat percentage was assessed using bioelectric impedance analysis.
- Nutrient Intake: 3-day diet record for 3 consecutive days (2 weekdays and 1 weekend day). Parents were to write down the time when food was eaten, all food and snacks consumed, the amount consumed, and methods of preparation
- If vitamin or mineral supplements were used, the brand name, content, dose, and frequency were recorded so as to determine total (diet plus supplement) nutrient intake.
- The nutrition composition of the 3-day dietary records was calculated using Nutritionist Professional software (E Kitchen Business Corp., Taiwan, 2002) and the nutrient data based on Taiwan food composition tables.

- Fasting venous blood samples to estimate hematologic and vitamin status parameters using standardized laboratory procedures

**Independent Variables**

- Vegetarian
- Omnivorous

**Control Variables**

- Age
- Sex
- Sociodemographic characteristics, social class and employment status of participating parents.
- Blood pressure (systolic and diabolic blood pressure), exercise habits and medical history were recorded.

**Description of Actual Data Sample:**

**Initial N**:

56 omnivores (28 children and one of their parents) and 42 vegetarians (21 children and one of their parents).

**Attrition (final N):** as above

**Age**: See table I in Results

**Ethnicity**: assumed Asian

**Other relevant demographics**:

**Anthropometrics**

**Location**: Chaoyang University of Technology, Taichung, Taiwan

**Summary of Results:**

**Key Findings:**

- Height, weight, BMI, WHI, and triceps skinfold thickness value differences between omnivores and vegetarians in both parent and child groups were not found
- Both omnivorous parents and children had significantly higher fat and lower fiber intakes than vegetarian parents and children
- Most subjects had nutrient intakes above the Taiwan Dietary Reference Intake (DRI); only calcium consumption was less than 75% of the Taiwan DRI (adult, 1000 mg/d; 4-year old child, 600 mg/d).
- There was a significant correlation between vegetarian parents and their children in dietary protein (r=0.57, P=.026), fat (r=0.61, P=.016), vitamin C (*r*=0.61, P=.015), and fiber (*r*=0.53, P=0.45) intakes.

- In contrast with the vegetarian group, vitamin A ($r$=0.60, P=.002), iron ($r$=0.65, P<.001), and fiber ($r$=0.71, P<.001) intakes of omnivorous parents significantly correlated with their children's intakes.

- All mean hematologic and biochemical nutrient status indices were within the reference range in any groups
- However, both vegetarian parents and children had significantly lower mean total cholesterol and serum ferritin concentrations than those of omnivorous parents and children

**Other Findings:**

The characteristics of vegetarians and omnivore subjects are shown in Table 1. The vegetarian group included 34 lacto-ovo-vegetarians, 5 ovo-vegetarians, 1 lacto-vegetarian, and 2 vegans. Vegetarian parents and children had followed this diet practice for a mean of 8.6 and 4.5 years, ranging from 1 to 35 and 1 to 7 years, respectively.

Omnivorous parents had a higher percentage of obesity (BMI> 27 kg/m$^{2)}$ than vegetarian parents, whereas vegetarian parents had a significantly higher percentage of overweight (BMI, 24-27 kg/m$^{2)}$ than omnivorous parents.

Vegetarian children had significantly lower mean total cholesterol, HDL-C, and serum ferritin concentrations than those of omnivorous children. In examining the correlation of hematologic and biochemical values between parents and their children, associations were found in WBC (r=0.61, P=.003), albumin (r=.56, P=.008), and total cholesterol (r=0.69, P<.001) levels between vegetarian parents and children. There were significant correlations in BUN (r=0.47, P=.013), uric acid (r=0.44, P=0.23), and total cholesterol (r=0.48, P=.012) levels between omnivorous parents and children.

**Author Conclusion:**

In conclusion, our vegetarian and omnivorous preschool children had normal growth and adequate nutritional status. However, both parents and children had inadequate calcium intakes, which may potentially affect bone health, especially for preschool children in the growing stage. Vegetarian or omnivorous parents influenced their children's dietary intakes and consequential biochemical values. As long as parents can provide an adequate vegetarian diet and care for their preschool children, vegetarian children at each stage can meet their dietary requirements and have normal growth and nutritional status in the same way as omnivorous children do.

***Reviewer Comments:***

*Authors note the following limitations:*

- *Small sample size*
- *The nutrient sources were not measured in the study.*
- *Supplement use might be another reason that the total nutrient intake increased.*
- *Reference values on anthropometric indicators for Taiwan population have not been established. Therefore, the researchers reported using the data reported by National and Health Survey in Taiwan, 1993 - 1996.*

*Research Design and Implementation Criteria Checklist: Primary Research*

| Relevance Questions | | |
|---|---|---|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | Yes |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | Yes |

| Validity Questions | | |
|---|---|---|
| **1.** | **Was the research question clearly stated?** | Yes |
| 1.1. | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified? | Yes |
| 1.2. | Was (were) the outcome(s) [dependent variable(s)] clearly indicated? | Yes |
| 1.3. | Were the target population and setting specified? | Yes |
| **2.** | **Was the selection of study subjects/patients free from bias?** | Yes |
| 2.1. | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | Yes |
| 2.2. | Were criteria applied equally to all study groups? | Yes |
| 2.3. | Were health, demographics, and other characteristics of subjects described? | Yes |
| 2.4. | Were the subjects/patients a representative sample of the relevant population? | No |
| **3.** | **Were study groups comparable?** | Yes |
| 3.1. | Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT) | N/A |
| 3.2. | Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? | Yes |
| 3.3. | Were concurrent controls used? (Concurrent preferred over historical controls.) | N/A |

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| 3.4. | If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? | Yes |
| 3.5. | If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) | Yes |
| 3.6. | If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")? | N/A |
| **4.** | **Was method of handling withdrawals described?** | Yes |
| 4.1. | Were follow-up methods described and the same for all groups? | N/A |
| 4.2. | Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.) | N/A |
| 4.3. | Were all enrolled subjects/patients (in the original sample) accounted for? | Yes |
| 4.4. | Were reasons for withdrawals similar across groups? | N/A |
| 4.5. | If diagnostic test, was decision to perform reference test not dependent on results of test under study? | N/A |
| **5.** | **Was blinding used to prevent introduction of bias?** | Yes |
| 5.1. | In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? | N/A |
| 5.2. | Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) | Yes |
| 5.3. | In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? | Yes |
| 5.4. | In case control study, was case definition explicit and case ascertainment not influenced by exposure status? | N/A |
| 5.5. | In diagnostic study, were test results blinded to patient history and other test results? | N/A |
| **6.** | **Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?** | Yes |
| 6.1. | In RCT or other intervention trial, were protocols described for all regimens studied? | N/A |
| 6.2. | In observational study, were interventions, study settings, and clinicians/provider described? | Yes |

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| 6.3. | Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? | N/A |
| 6.4. | Was the amount of exposure and, if relevant, subject/patient compliance measured? | Yes |
| 6.5. | Were co-interventions (e.g., ancillary treatments, other therapies) described? | N/A |
| 6.6. | Were extra or unplanned treatments described? | N/A |
| 6.7. | Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? | N/A |
| 6.8. | In diagnostic study, were details of test administration and replication sufficient? | N/A |
| **7.** | **Were outcomes clearly defined and the measurements valid and reliable?** | Yes |
| 7.1. | Were primary and secondary endpoints described and relevant to the question? | N/A |
| 7.2. | Were nutrition measures appropriate to question and outcomes of concern? | Yes |
| 7.3. | Was the period of follow-up long enough for important outcome(s) to occur? | N/A |
| 7.4. | Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? | Yes |
| 7.5. | Was the measurement of effect at an appropriate level of precision? | Yes |
| 7.6. | Were other factors accounted for (measured) that could affect outcomes? | No |
| 7.7. | Were the measurements conducted consistently across groups? | Yes |
| **8.** | **Was the statistical analysis appropriate for the study design and type of outcome indicators?** | Yes |
| 8.1. | Were statistical analyses adequately described and the results reported appropriately? | Yes |
| 8.2. | Were correct statistical tests used and assumptions of test not violated? | Yes |
| 8.3. | Were statistics reported with levels of significance and/or confidence intervals? | Yes |
| 8.4. | Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? | N/A |
| 8.5. | Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? | Yes |
| 8.6. | Was clinical significance as well as statistical significance reported? | N/A |

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| 8.7. | If negative findings, was a power calculation reported to address type 2 error? | N/A |
| **9.** | **Are conclusions supported by results with biases and limitations taken into consideration?** | Yes |
| 9.1. | Is there a discussion of findings? | Yes |
| 9.2. | Are biases and study limitations identified and discussed? | Yes |
| **10.** | **Is bias due to study's funding or sponsorship unlikely?** | Yes |
| 10.1. | Were sources of funding and investigators' affiliations described? | Yes |
| 10.2. | Was the study free from apparent conflict of interest? | Yes |